

PRELIMINARY



UM2851

A251x Series 50W LV Boards User Manual

Rev. 1 - 26 June 2014

Purpose of this Manual

This document is the A251x Series 50W LV Boards User Manual; it contains information about the installation, the configuration and the use of the boards.

Change Document Record

Date	Revision	Changes
26 May 2014	0	PRELIMINARY Release
26 June 2014	1	Updated parameters p.13

Symbols, abbreviated terms and notation

T.B.D.

Reference Documents

Disclaimer

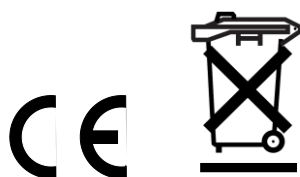
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CAEN declines all responsibility for damages or injuries caused by an improper use of the Modules due to negligence on behalf of the User. It is strongly recommended to read thoroughly the CAEN User's Manual before any kind of operation. *CAEN reserves the right to change partially or entirely the contents of this Manual at any time and without giving any notice.*

Disposal of the Product *The product must never be dumped in the Municipal Waste. Please check your local regulations for disposal of electronics products.*

Made In Italy : We stress the fact that all the boards are made in Italy because in this globalized world, where getting the lowest possible price for products sometimes translates into poor pay and working conditions for the people who make them, at least you know that who made your board was reasonably paid and worked in a safe environment. (this obviously applies only to the boards marked "Made in Italy", we cannot attest to the manufacturing process of "third party" boards).



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1. A251x Series Overview

The Mod. A251x series are single width (5 TE wide) boards housing 8 LV floating channels, compatible with the CAEN Universal Multichannel Power Supply System (SY1527, SY2527, SY3527, SY4527, SY5527). The floating return allows on-load grounding reducing the noise level; the floating channels are insulated from each other and from Ground up to ± 150 V.

Each output channel is provided with individual remote sensing lines to compensate for the voltage drop over the connection cables

The Maximum channel power is 50 W (connector output). Channels can be connected in parallel with modularity 2 or 4 to obtain higher output power (for 2/4 modularity Iset resolution is 100 mA and Imon resolution is 10 mA).

The available versions are the following:

Version:	A2517	A2518	A2519
Output Voltage:	1÷5 V	3÷8 V	5÷15 V
Max. Output Current:	15 A	10 A	5 A

The Output Voltage RAMP-UP and RAMP-DOWN Times may be selected independently for each channel in the 1 ÷ 200 ms range (1 ms step).

Safety features include:

OVERVOLTAGE: if a channel monitored voltage goes above the programmed Overvoltage threshold value (OVVThr), it is signalled to be in "overvoltage" and is switched off.

UNDERVOLTAGE: when the monitored voltage goes below the programmed undervoltage threshold (UNVThr), the channel is switched off

OVERCURRENT: if a channel tries to draw a current larger than its programmed limit, it is signalled to be in "overcurrent" and is switched off.

The output channels can be enabled according to the interlock logic (see Interlock operation)

All versions are available either with 8 pin 0.15"pitch high current output connectors; A2518 and A2519 series are provided also with db 37 output connectors.

A global enable/disable connector allows to disable the channels and it is also possible, via front panel logic signals, to enable individually each channel (only for db 37 versions).

Channels are organized into groups, and the turning on/off of the channels within one group can be delayed up to 900ms (User programmable) between each other.

Channels feature a PID (proportional integrative-derivative) digital controller, whose parameters are User programmable; in this way, the control loop can be optimized to any load.

2. Technical Specifications

Channel Characteristic Table

Table 1 – Channel characteristics of the A251x LV Boards

Version	A2517	A2518	A2519
Packaging	1 unit (5 TE) wide, 6U-high mechanics		
No. of Channels	8 (Individual Floating)		
Polarity	Floating		
Output Voltage	1÷5 V (connector output)	3÷8 V (connector output)	5÷15 V (connector output)
Voltage Ripple	< 10 mV pp (T.B.C.)		
Max. Output Current	15 A	10 A	5 A
Max. Ch. Output Power	50 W (firmware limited)		
Minimum Load	0 A		
Voltage Set Resolution	1 mV		
Vset Accuracy	< ±0.5%		
Voltage Monitor Resolution	1 mV (connector and status)		
Current Set Resolution	10 mA; 100 mA (2/4 modularity)		
Current Monitor Resolution	1 mA ; 10 mA (2/4 modularity)		
Over/Under voltage thresholds	0÷6 V settable for each channel	2÷9 V settable for each channel	4÷16 V settable for each channel
Over/Under voltage thr. resolution	10 mV		
Hardware OVV Protection	7.50V	9.75V	17.50V
Short Circuit Protection	Available		
Ramp Up/Down Time	1÷200 ms ; 1 ms step		
Turn on/off delay	0 ÷ 900ms		
Transient response	Adjustable via PID controller		
RTN – GND Isolation	±150V		
Sense cable input impedance	1 kOhm		
Enable inputs	Available		
Status outputs	Available		
Temperature range	5° ÷ 85° C		

Front Panel

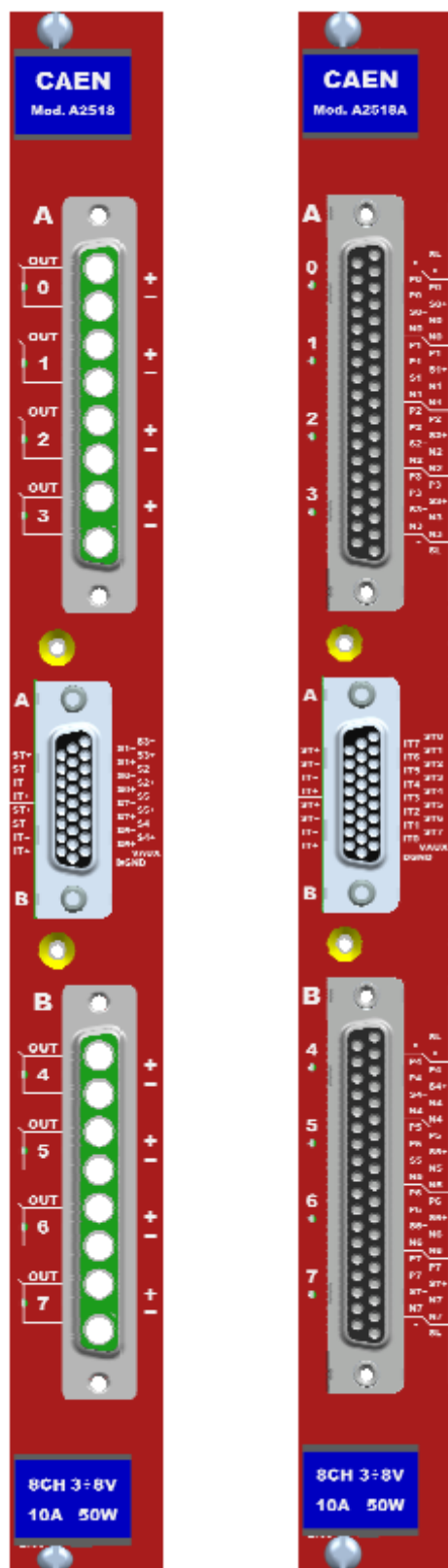
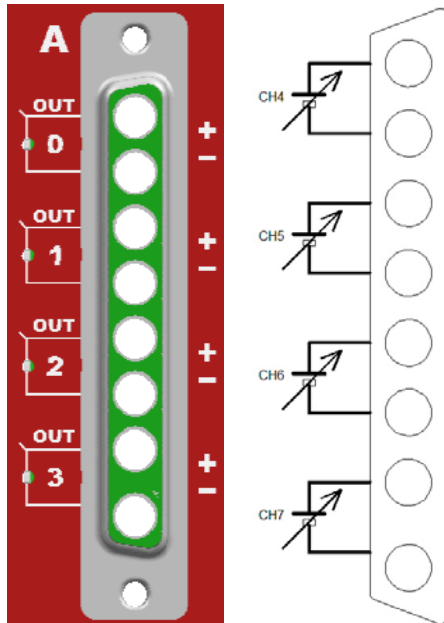


Fig. 1 – Mod. A251x series front panel (8 pin & db 37 version)

External connections

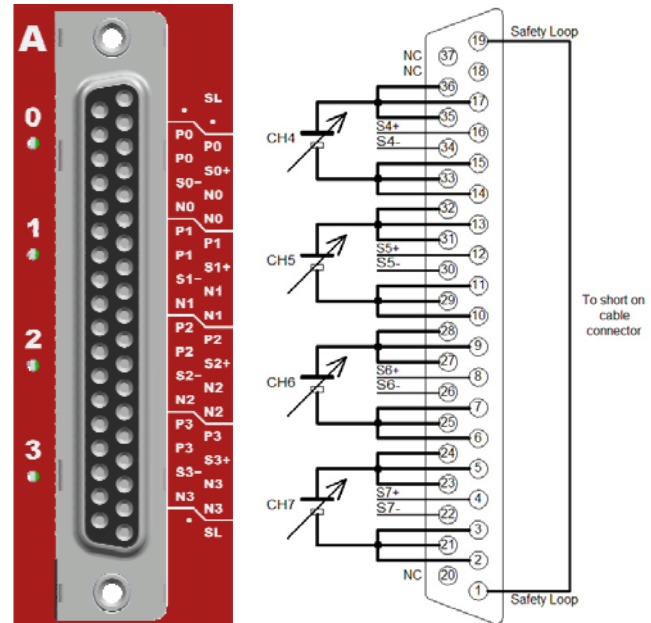
Output connectors

A251x



Type: DC8W8SA00LF D-Sub 8W8
Function: Out Channels (0÷3; 4÷7)

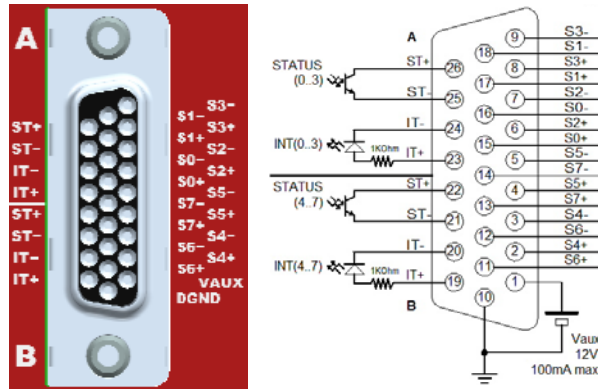
A251xA



Type: FCI DCPV37S300GT DB37
Function: Out Channels (0÷3; 4÷7)

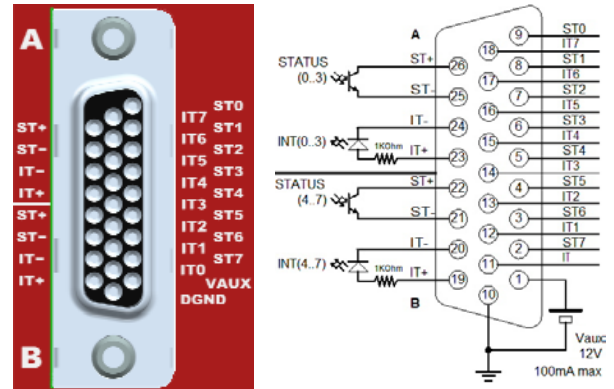
Service connector

A251x



Type: FCI ICD26S13E4GV00LF D-Sub SKT 26 POS 2.28mm
Function: Group Interlock (insulated); Group Status (insulated); Status (0...3; 4...7); VAUX, DGND

A251xA



Type: FCI ICD26S13E4GV00LF D-Sub SKT 26 POS 2.28mm
Function: Group Interlock (insulated); Group Status (insulated); Individual Interlock (GND); Individual Status (GND); VAUX, DGND

Interlock operation

A251x

One Group (channels 0..3 and 4..7) can be ENABLED in one of the following ways:

- Short circuit IT- with DGND and IT+ with VAUX pins on service connector
- Send signal 4÷6V, ~5mA current between IT- and IT+

A251xA

One Group (channels 0..3 and 4..7) can be ENABLED in one of the following ways:

- Short circuit IT- with DGND and IT+ with VAUX pins on service connector
- Send signal 4÷6V, ~5mA current between IT- and IT+

One channel can be ENABLED in one of the following ways:

- Short circuit IT# with VAUX pins on service connector
- Send signal 4÷6V, ~5mA current between IT# and DGND

Status operation

A251x

- Contact closed between ST+ and ST- when no FAIL is present on one Group channel (0..3 and 4..7)
- Contact open between ST+ and ST- when FAIL is present on one Group channel (0..3 and 4..7)

A251xA

- Contact closed between ST+ and ST- when no FAIL is present on one Group channel (0..3 and 4..7)
- Contact open between ST+ and ST- when FAIL is present on one Group channel (0..3 and 4..7)
- Level high on ST# when no FAIL is present
- Square wave (TTL grounded) on ST# when FAIL is present

Channels in parallel

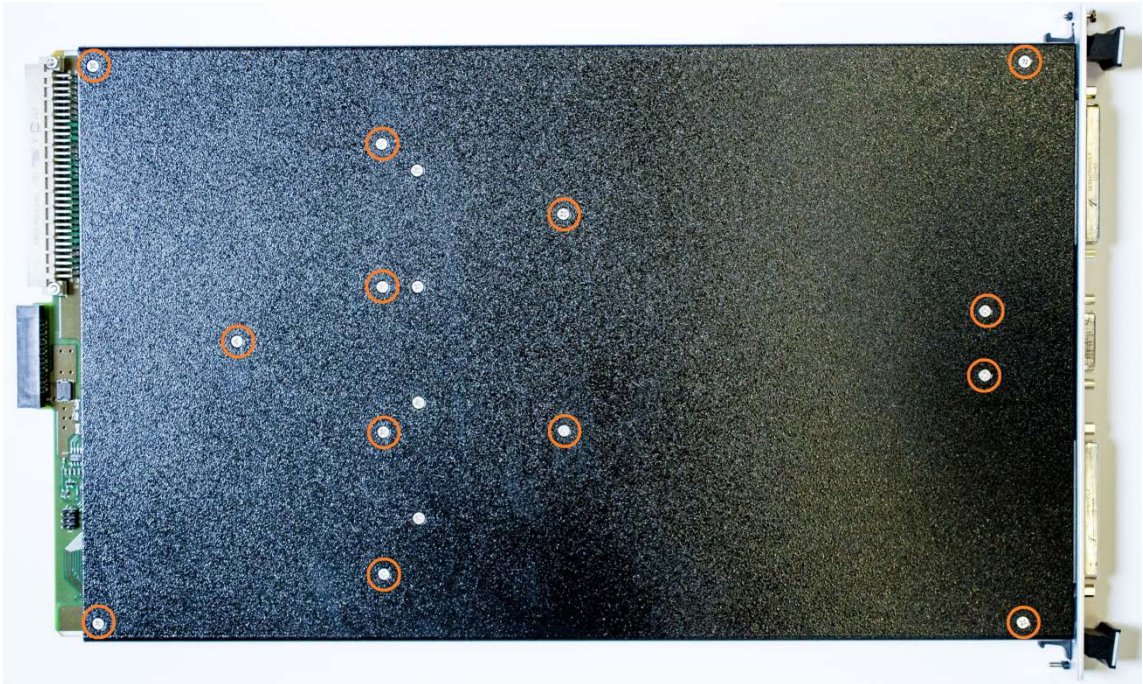
The A251x boards are provided with six Connection Keys (four X keys and two Z keys), that allow to connect the channels in parallel.

The X key allows to parallel two channels, the Z key allows to parallel four channels.

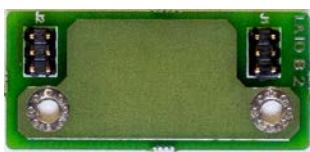
As two or four channels are paralleled, the system automatically recognizes the actual number of channels: two or four paralleled channels are seen by the control software as one channel with double or quadruple output current and power.

In order to connect the channels in parallel, follow these steps:

- Remove ONLY the screws as indicated (orange circles)



- Remove carefully the shield
- Insert the Connection Keys between the channels to be paralleled
 - Each connection key is provided with 2x3 pin male strips (two for X keys and four for Z keys)

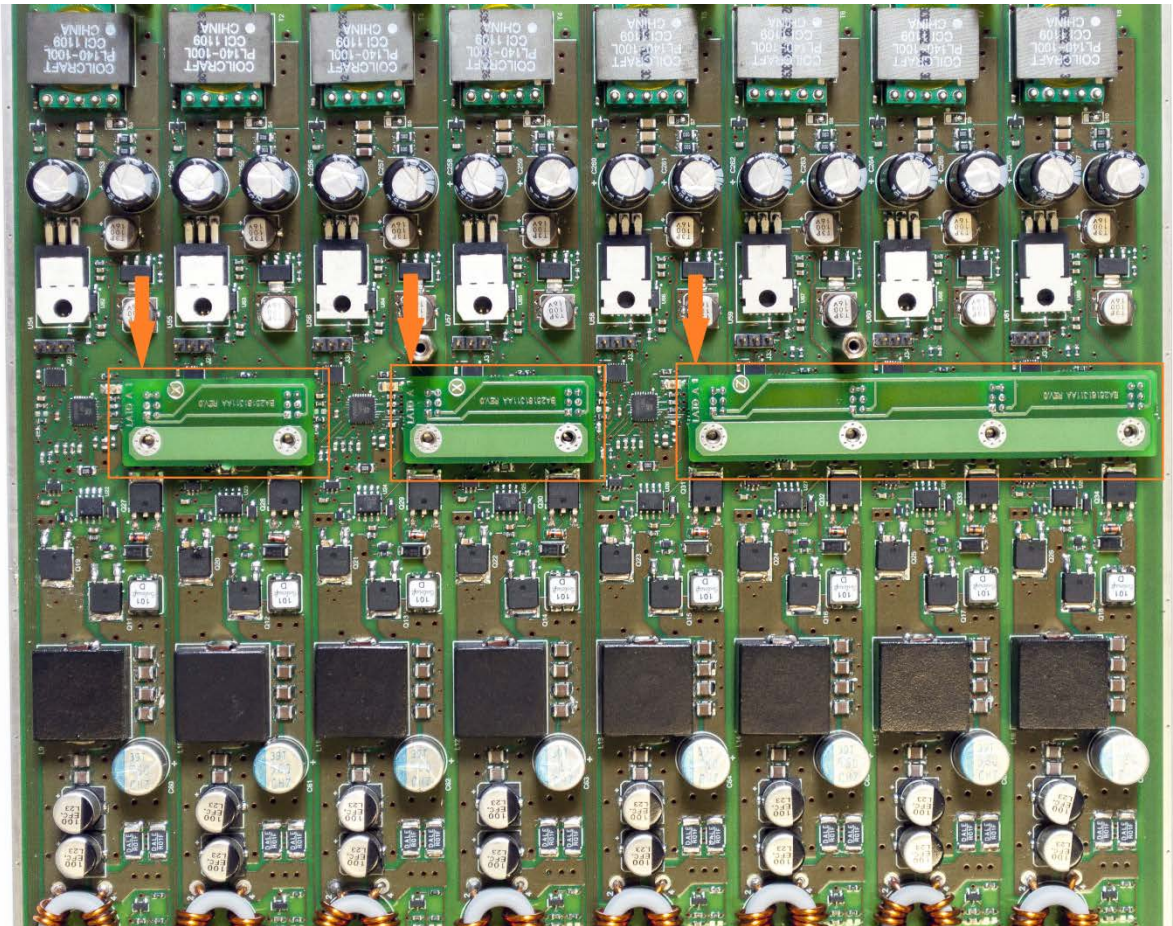


X key



Z key

- The 2x3 strips must be plugged into the relevant sockets on A251x (named J20÷J27, see figure)



- Secure the Connection Keys with the provided screws, grover washers, flat washers



All adjacent channels can be paralleled, with the exception of Channel 3 and 4. The pictured configuration shows:

- Channels 0-1 paralleled
- Channels 2-3 paralleled
- Channel 4-5-6-7 paralleled

With this configuration the SYx527 system detects 3 channels (0, 2, 4); the lower channel index is assigned to the paralleled channels.

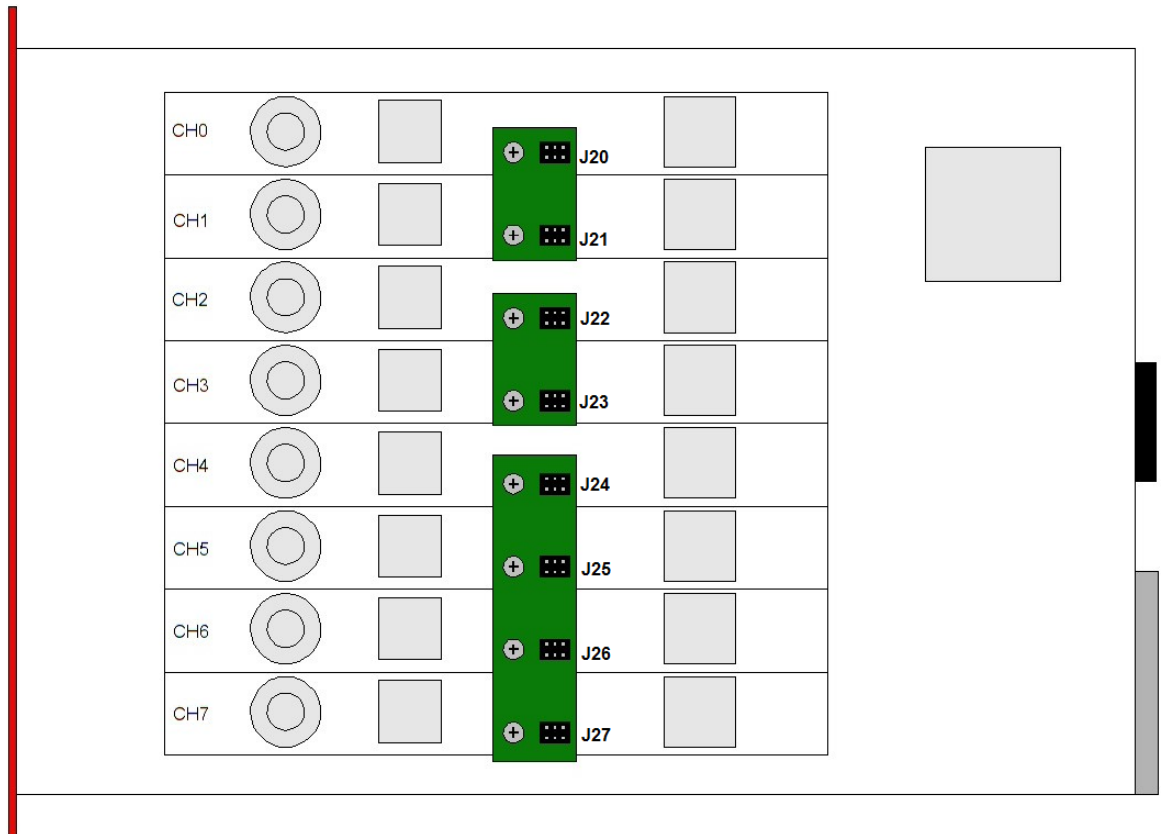


Fig. 2 – Mod. A251x with paralleled channels

Once the Connection Keys are secured, it is possible to put the shield in place.

Remember that, at this point, it is necessary to short circuit the paralleled channels output; these connections must be made as close as possible to the connectors, for both positive and negative voltages.

The same procedure is necessary for the Sense terminals.

3. Safety and installation requirements

General safety information

This section contains the fundamental safety rules for the installation and operation of the board. Read thoroughly this section before starting any procedure of installation or operation of the product.

Injury Precautions

Review the following precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use the product only as specified. Only qualified personnel should perform service procedures.

Avoid Electric Overload.

To avoid electric shock or fire hazard, do not power a load outside of its specified range.

Avoid Electric Shock.

To avoid injury or loss of life, do not connect or disconnect cables while they are connected to a voltage source.

Do Not Operate Without Covers.

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions.

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere.

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Do Not Operate With Suspected Failures.

If you suspect this product to be damaged, have it inspected by qualified service personnel.

Safety Terms and Symbols on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

The following symbols may appear on the product:



DANGER
High Voltage



WARNING
Refer to Manual

Installation

The A251x are single-width boards. At power ON the SYSTEM, the processor will scan all the slots in the crate to find out where the module is plugged and what kind of module it is.

4. Operating modes

The A251x boards can be controlled, either locally or remotely, through the SYSTEM software interface. For details on SYx527 System operation, please refer to the User's Manual of this product. The following sections contain a description of commands available for the board control and status monitoring.



WARNING

THE MOD. A251x BOARD REQUIRE
SYSTEM FIRMWARE VERSION 2.00.01 OR LATER

Output control and monitoring

The following board parameters are available:

Parameter	Description
BdStatus (monitor)	bit 0: PowerFail; if 1, failure in the channels local power supply bit 1: Firmware Checksum Error; if 1, error in the board firmware checksum bit 2: HVMax Calibration Error; if 1, the board HVMax parameter (if present) is not calibrated bit 3: Temperature Calibration Error; if 1, the board temperature sensor (if present) is not calibrated bit 4: Under Temperature; if 1, the board temperature sensor (if present) signals a board temperature < 5 °C bit 5: Over Temperature; if 1, the board temperature sensor (if present) signals a board temperature > 65 °C bits 6..31: Reserved
OnGroup (settable)	Turn ON channel associated to the selected group
OffGroup (settable)	Turn OFF channel associated to the selected group
Intck A (settable)	Enable /disable operation of IT+/- signals of section A
Intck B (settable)	Enable /disable operation of IT+/- signals of section B

For each output channel, the following parameters are available:

Parameter	Description
CHANNEL NAME (settable)	Descriptive name for the relevant channel
VOSET (settable)	Output voltage programmable value
IOSET (settable)	Current limit programmable value
UNVTHR (settable)	Set output under voltage threshold
OVVTHR (settable)	Set output over voltage threshold
RUpTime (settable)	Set voltage ramp-up time
RDWnTime (settable)	Set voltage ramp-down time
VMON (monitor)	Monitored voltage value
VCON (monitor)	Monitored connector voltage value
IMON (monitor)	Monitored current value
STATUS (monitor)	Displays the channel status
PW (ON/OFF)	Power parameter shows the ON/OFF channel status; when set to ON, the channel is switched on (if the INTERLOCK is not active and if the channel is enabled either locally or remotely)
TripInt (settable)	2N-bit word (Dec. $0 \div 2^{2N-1}$) max 16 lines, where N is the number of the board's Internal Trip Bus lines. Bits [0;N-1] allow the channel to sense the trip status from the corresponding lines when set to one; in the same way, bits [N;2N-1] allow the channel to propagate the trip status over the Trip Bus: bit N on line 0 and so on (see SY4527 User's manual)
TripExt (settable)	Must be set in the $0 \div 255$ range. Bits [0;3] allow the channel to sense the trip status from the corresponding lines when set to one; in the same way, bits [4;7] allow the channel to propagate the trip status over the trip bus: bit 4 on line 0 and so on (see SY4527 User's manual)
ONGRDEL (settable)	Set ON delay between channel in the same group
OFFGRDEL (settable)	Set OFF delay between channel in the same group
CHTOGROUP (settable)	Number of group to associate the channel
TEMP (monitor)	Monitored channel temperature
Intck	Enable/Disable operation of channel interlock signals (only A251xA versions)

All parameters can be changed when the channel is off. When the channel is switched on, only a variation of VSET in a range of $\pm 5\%$ is allowed, for adjustment purposes.

To ensure that two or more channels are turned on / off with delays programmed by user, these channels must be assigned the same value of the ChToGroup parameter and the desired time must be entered in the OnGrDel and OffGrDel parameters (0 = no delay). The switching on and off are performed by entering the ChToGroup parameter value in the field OnGroup / OffGroup, (available as parameters of the board).

The following messages may be returned by the SYSTEM when monitoring the channel status:

OFF	(channel turned OFF)
OVC	(channel in OVERCURRENT condition)
OVV	(channel in OVERVOLTAGE condition)
UNV	(channel in UNDERVOLTAGE condition)
EXTTRIP	(channel OFF due to external TRIP line signal) ¹
INTTRIP	(channel OFF due to internal OVERCURRENT condition)
EXT_DIS	(channel disabled by board INTERLOCK protection)
PWR_FAIL	(channel OFF due to a Power failure)
OVV_PROT	(channel with connector over voltage detected)
TEMP_ERR	(channel over $>85^{\circ}\text{C}$ / under $<5^{\circ}\text{C}$ temperature)

PID (Proportional Integrative Derivative) Parameters

The channels implement a digital type controller. The user has the possibility to change the loop parameters (Kp, Ki and Kd). These operations are not allowed by CAENGECO2020 Control Software, but they can be done only in transparent mode (see SY4527 manual). By typing P from the main menu, it is possible to open the interface to modify the PID coefficients of the channels. All changes of the coefficients are saved by typing S.

N.B. The PID coefficients can be modified when the channels are switched off. In case of change of the coefficients with the channels on, a confirmation message asks authorization to turn off the channel and change the coefficients.

¹ EXTTRIP and INTTRIP parameters are expressed in Hexadecimal format



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